U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Glyphopsyche sequatchie* (Etnier and Hix)

COMMON NAME: Sequatchie caddisfly

LEAD REGION: 4

INFORMATION CURRENT AS OF: March 2010

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X_ Continuing candidate

___ Non-petitioned

_X_ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_ 12-month warranted but precluded - FR date:

_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): October 25, 1999

___ Candidate removal: Former LP: ___

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Insects – Limnephilidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Tennessee

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Marion County, Tennessee

LAND OWNERSHIP: One population is located on county-owned property and one population is on private property.

LEAD REGION CONTACT: Rob Tawes, 404/679-7142, robert_tawes@fws.gov

LEAD FIELD OFFICE CONTACT: Cookeville, Tennessee, Field Office, Stephanie Chance, 931/528-6481, extension 211, stephanie_chance@fws.gov

BIOLOGICAL INFORMATION:

Description

Several characters are useful for diagnosing membership in the Trichopteran family Limnephilidae including consistent location of each antenna (paired sensory organs) about midway between eye and anterior (front) edge of head, with prosternal horn (projection on the underside of the first segment of the thorax [middle body segment]) and chloride epithelia (egg shaped areas on the abdomen) almost always present (Wiggins 1977, p. 45). In the Sequatchie caddisfly (*Glyphopsyche sequatchie*), the chloride epithelia are present on abdominal segments III-VIII (Etnier and Hix 1999, p. 628). The extensive development of setae (hairlike projections) on abdominal segment I in many Limnephilidae is not common among other Trichopterans and nearly unique to the Nearctic caddisfly families (Wiggins 1977, p. 180). The genus *Glyphopsyche* is among the few members of the Limnephilinae whose larvae in North America have dark-colored bands on the legs, and contains the only such members with branched gills. *Glyphopsyche* larvae have stout setae on the lateral sclerite (hardened body wall on the side of the larvae) of the anal proleg (paired, retractable processes with spines) and on the anterior edge of the pronotum (shield on the first segment of the thorax) (Wiggins 1977, p. 224).

Etnier and Hix (1999, p. 625) found adult male *G. sequatchie* separable from *G. irrorata* and *G. missouri* (the other two U.S. species in the genus, the former being boreal and the latter only known from one spring in Missouri) on the basis of: (1) having two rather than three patches of black spinules on the posterior (back) margin of the eighth abdominal tergite (plates on the top of the abdomen); (2) having an elongate projection on the inferior (ventral) appendage of abdominal segment X; (3) having three pairs of elongate sclerotized (hardened) dorsal (top) and

intermediate processes on abdominal segment X (versus 2 pairs of short processes); (4) having the length of the phallic parameres (spines of genitalia) more than twice the diameter of the phallus; and (5) virtually lacking a partial crossvein (short wing vein connecting two major wing veins) between veins Sc and R1 (major veins along front edge of wing) at the cord versus with a crossvein extending from Rs more than halfway to Sc. Adult females, pupae, and larvae are also easily separable from these species.

Taxonomy

Etnier and Hix (1999) described *G. sequatchie*, which is a member of family Limnephilidae, subfamily Limnephilinae, tribe Chilostigmini (Wiggins 1977).

Habitat and Distribution

The Sequatchie caddisfly (*Glyphopsyche sequatchie*) is only known from two spring runs in Marion County, Tennessee - Owen Spring Branch (the type locality) and Martin Spring run in the Battle Creek system (Etnier and Hix 1999, pp. 629-630). Both springs emerge from caves. The spring and spring run at Owen Spring Branch are within Sequatchie Cave Park, a small county park that extends to Old Highway 28, about 200 meters (m)(656 feet (ft)) below the cave entrance. The Sequatchie Cave Park was designated as a Class II Natural-Scientific State Natural Area on April 4, 2001. Owen Spring Branch averages about 12 m (39 ft) wide and 0.5 m (1.6 ft) deep and flows over a substrate of chert gravel, with silt and organic matter in the pool areas. About 15 m (49 ft) above Old Highway 28, an unnamed tributary of the Little Sequatchie River joins the spring run to form Owen Spring Branch. Another first order stream joins Owen Spring Branch before entering the Sequatchie River about 1.3 kilometers (km) (0.8 miles (mi)) below Owen Spring. The species occurs in the spring run from about 30 m (98 ft) below the entrance of the cave downstream to about 150 m (492 ft) below the highway, a reach of about 300 m (984 ft). No specimens were found in the Little Sequatchie tributary, where water temperatures are warmer (Etnier and Hix 1999, p. 629).

The Martin Spring site was discovered in May 1998 and is about 19 linear kilometers (12 linear miles) west-northwest from the type locality. This spring also emerges from a cave and has about twice the width and discharge of Owen Spring. Though there appears to be twice as much suitable habitat, *G. sequatchie* were more difficult to find at this site.

Life History

While no studies of the life history of the Sequatchie caddisfly have been conducted, general caddisfly life history characteristics are summarized here from Wiggins (1977). Caddisflies at temperate latitudes typically complete one generation each year, consisting of five larval instars, a pupal stage, and a winged adult stage. The process from separation of the larval cuticle to emergence of the adult from the pupal skin typically occurs over about three weeks, though exceptions have been noted at the species level (Wiggins 1977, pp. 22-25). Larvae of the subfamily Limnephilinae feed primarily on plant materials, reducing pieces of plant debris to small particles (Wiggins 1977, pp. 19-20).

Etnier and Hix (1999, p. 628) found *G. sequatchie* larval cases to be extremely variable, ranging from entirely vegetative material to entirely mineral material, though tending to have higher proportions of vegetation than in *G. missouri*. Sequatchie caddisfly larvae were large enough to be identified by early June and were in final instar in early September, found in pools and gently flowing runs on dead limbs 5-10 centimeters (2-4 inches) in diameter with bark still attached (Etnier and Hix 1999, p. 629). Other larvae were found on larger logs, with and without bark, and in wads of root hairs. Larvae were not found on rocks in the stream. Etnier and Hix (1999, p. 629) reared final instar larvae collected on September 27 until they emerged on dates ranging from October 31 through February 4. They suspected that this pattern, which could have been an artifact of laboratory rearing, would be similar to emergence patterns expected under natural conditions.

Population Estimate

Based on an effort to census all Sequatchie caddisfly larvae in the approximately 300-meter (984 ft) reach of Owen Spring Branch, Etnier and Hix (1999, p. 630) estimated the population size for Owen Spring at 500 to 5000 individuals. They estimated the population could be 2 to 10 times larger at Martin Spring, due to the greater amount of apparently suitable habitat. More recently, Dr. David Etnier reported that the Sequatchie caddisfly was "abundant" at the type locality during observations in 2001, while only two individuals were observed at the Martin Spring locale (D. Etnier, University of Tennessee-retired, pers. comm., 2009).

THREATS (also see Appendix A: Threats Assessment Matrix)

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

The Sequatchie caddisfly is known from only two spring runs in Marion County, Tennessee, and has never been found outside these areas. This extremely limited distribution, small population size, the limited amount of occupied habitat, the ease of accessibility, and the species' annual life cycle make the Sequatchie caddisfly extremely vulnerable to extirpation. Threats to the species include siltation, point and nonpoint discharges from municipal and industrial activities, and introduction of toxicants during episodic events. Siltation from off-road vehicle (ORV) use in the spring runs, adjacent banks, and immediately upslope of the cave entrance at Owen Spring is a threat to the Owen Spring population. The Tennessee Department of Environment and Conservation and Marion County Highway Department installed a cable and rock barrier to limit this type of harm, but a limited amount of use is still occurring on the upstream side of the cave entrance. There is potential for this threat to increase in the future at both sites. Beaver activity has inundated downstream portions of Owen Spring Branch, and could become a threat to the Sequatchie caddisfly if continued upstream into the spring run. Sawdust disposal by the Sequatchie Handleworks mill presented a historic threat to the Owen Spring Branch population, but should be monitored for reoccurrence. If it occurred, timber harvesting on the Cumberland Plateau or its escarpment above the caves from which Owen or Martin springs emerge could also produce excessive siltation through surface and/or subsurface runoff. Point and nonpoint discharges from municipal and industrial activities do not pose imminent threats to the Sequatchie caddisfly, but should be monitored for potential increases. Episodic events, including

chemical spills or illegal garbage disposal, could introduce toxicants into these springs directly or through surface or subsurface flows.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

There is no indication that overutilization threatens the Sequatchie caddisfly. The specific areas inhabited by the Sequatchie caddisfly were not known to the scientific community until publication of the species description and, therefore, collecting has not been a significant threat. Collection from the Owen Spring Branch population requires a state-issued permit because it occurs within Sequatchie Cave Class II Natural-Scientific State Natural Area. The minimal collecting that has occurred for scientific purposes is not believed to pose a threat. Etnier and Hix (1999, p. 630), in their description of the species, urged the scientific community to treat this species as endangered because of its apparent vulnerability to extirpation due to its restricted distribution and small population sizes. The existence of this species and the specific areas it inhabits will likely not be widely known to the public until such time that a proposed rule to list the species is published.

C. Disease or predation.

Predation by naturally occurring predators is a normal aspect of the population dynamics of a species and is not considered a threat to this species. Introduced rainbow trout (*Oncorhynchus mykiss*) are present at the Martin Springs site and may pose a threat to the Sequatchie caddisfly. The extent of rainbow trout predation on this species is unknown. No diseases are known to affect the species.

D. The inadequacy of existing regulatory mechanisms.

Collection from the Owen Spring Branch population requires a state-issued permit because Owen Spring Branch is part of the Sequatchie Cave Class II Natural-Scientific State Natural Area. This population receives incidental legal protection under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act), because the federally-endangered royal snail (*Pyrgulopsis ogmorhaphe*) also occupies this spring. The federally-endangered pale liliput (*Toxolasma cylindrellus*) was collected from Owen Spring Branch in 1955, though its current status at the site is unknown. Martin Spring is on private land and receives no legal protection. However, the current landowner is aware of the presence of the Sequatchie caddisfly and is generally protective of its habitat.

Federal listing would provide more stringent protection for the Sequatchie caddisfly by prohibiting take in the absence of a permit issued under section 10 of the Act. More importantly, federal listing could prevent habitat degradation and water quality impairment in Owen and Martin springs by requiring federal agencies to consult with the Service when projects they fund, authorize, or carry out may adversely affect the species.

E. Other natural or manmade factors affecting its continued existence.

Because the Sequatchie caddisfly is presently restricted to two small spring runs, it would be

vulnerable to localized extinctions from intentional or accidental toxic chemical spills or other stochastic disturbances, should they occur in the watersheds drained by Owen or Martin springs. Due to the short life span of this species and physical isolation of its two populations from each other, recolonization of any extirpated population would be unlikely without human intervention.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED:

Owen Spring Branch flows from the mouth of Sequatchie Cave, which is part of a ten-acre, Class II Natural-Scientific State Natural Area (SNA) designated by the State of Tennessee in 2001. The Sequatchie Cave SNA is located within Sequatchie Cave Park, which is managed by the Marion County Highway Department (MCHD) on behalf of the Marion County Conservation Committee. The Tennessee Department of Environment and Conservation – Division of Natural Areas (DNA) has prepared a management plan for this SNA, which identifies the Sequatchie caddisfly as one of six species targeted for conservation efforts. The management plan is only implemented as funding allows, but one of the goals is to "restore and maintain the water quality of Owen Spring Branch and the ecological integrity of the natural area." In 1997, the Service awarded the DNA a Partners for Fish and Wildlife Grant to perform habitat management and restoration activities for the royal snail at Owen Spring Branch (Tennessee Division of Natural Heritage 2000). In 1998, wood waste deposited by the handleworks mill was removed from Owen Spring Branch. The waste from the mill is now collected as fuel for the facility's boiler rather than being deposited streamside. Also in 1998, Tennessee Fur Harvesters Association volunteers trapped several beavers from Owen Spring Branch, and the DNA subsequently removed a beaver dam that winter. These efforts are reported to have improved flow conditions in the spring run. Working with the MCHD, the Tennessee Department of Transportation, Sequatchie Concrete, and local volunteers, the DNA installed a guardrail/cable fence to prevent off-road vehicle access to Owen Spring Branch in 1999 and stabilized eroding banks caused by previous ORV use of the site. In 2000, DNA and MCHD began removing exotic vegetation along Owen Spring Branch in an effort to restore native riparian vegetation and desirable thermal conditions to the spring run. Also in 2000, these agencies installed water bars, berms, and straw bales to abate erosion of a retired logging road that had become a source of sediment pulses into Owen Spring Branch following storm events. The Sequatchie community supports restoration efforts at Owen Spring Branch, as evidenced by local volunteer leadership in planning and participation in onsite activities.

SUMMARY OF THREATS:

Threats to the Sequatchie caddisfly include siltation, point and nonpoint discharges from municipal and industrial activities, and introduction of toxicants during episodic events. These threats, coupled with the species' extremely limited distribution, apparent small population size, limited amount of occupied habitat, ease of accessibility, and the species' annual life cycle, are all factors that leave the Sequatchie caddisfly vulnerable to extirpation. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES:

Refer to Conservation Measures Planned or Implemented.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	**5***
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: This species is known from only two easily accessible spring runs in Tennessee. Because the Sequatchie caddisfly occurs in limited numbers in these two spring runs, it is vulnerable to local extirpation or perhaps even rangewide extinction due to both random, catastrophic environmental (or human-induced) events and/or gradual changes in human land use patterns over time. The species was abundant at Owen Spring Branch in 2001, and this site enjoys protection as a Class II Natural-Scientific State Natural Area (SNA) since its designation as such by the State of Tennessee in 2001. We consider these threats to be of a high magnitude.

Imminence: These threats are mostly historic and/or future. Therefore, we consider these threats to be non-imminent at this time.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No, we believe that emergency listing is not warranted at this time for the Sequatchie caddisfly. We also believe that alternative conservation strategies, such as attempting to establish a cooperative management agreement with the Martin Spring landowner, should be pursued as a means of removing potential anthropogenic threats to this species on private land rather than initiating listing under the Act at this time.

DESCRIPTION OF MONITORING:

Monitoring for the Sequatchie caddisfly has consisted of periodic, informal site visits by species experts. Dr. David Etnier reported that the Sequatchie caddisfly was abundant at the type locality during observations in 2001, while only two individuals were observed at the Martin Spring locale (D. Etnier, pers. comm., 2009). The Service contacts species experts and biologists with State agencies annually to solicit information regarding either monitoring activities conducted for this species or management activities that could affect its status in the two locations from which it is known. The Service also maintains contact with the landowner at the Martin Spring Run locality in order to learn of any disturbances or potential land use changes in close proximity to the site. This level of monitoring provides limited information for updating this form. Regularly scheduled and standardized monitoring is needed to strengthen this assessment by providing current data for completing the threats assessment matrix and for documenting the species status in its two known locations.

In 2009, Dr. Moulton at the University of Tennessee was awarded funds to estimate the population size of the Sequatchie caddisfly at both spring locations. In addition to surveying numbers at the two proven localities, he will survey for additional populations and will determine the level of genetic diversity at each site. Using DNA sequences from both mitochondrial and nuclear markers, he will determine the degree of gene flow between the Owen Spring and Martin Spring run populations.

COORDINATION WITH STATES:

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: None. Tennessee had no new information to provide regarding this species.

STATES THAT INCLUDE THE SPECIES IN THEIR WILDLIFE ACTION PLANS:

The Sequatchie caddisfly is included in Tennessee's Comprehensive Wildlife Conservation Strategy (CWCS) (TWRA 2005) as a Tier 2 species of greatest conservation need. Tier 2 of Tennessee's CWCS includes all fauna not defined as wildlife under Tennessee law (i.e. insects and other invertebrates). Currently, these fauna are not covered under any other legal statutes in the State and no State agency has responsibility for their management (TWRA 2005).

LITERATURE CITED:

Etnier, D.A. 2009. Personal communication. Verification of species and habitat information. University of Tennessee, retired. (February 18, 2009).

Etnier, D. A., and R. L. Hix. 1999. A new *Glyphopsyche* Banks (Trichoptera: Limnephilidae) from southeastern Tennessee. Proceedings of the Entomological Society of Washington 101:624-630.

Tennessee Division of Natural Heritage. 2000. Conservation and enhancement of two populations of the royal snail (*Pyrgulopsis ogmorhaphe*) in Jasper and Sequatchie, Marion County, Tennessee. Report submitted to the U. S. Fish and Wildlife Service,

Asheville, North Carolina. 23 pp.

Tennessee Wildlife Resources Agency. 2005. Tennessee's Comprehensive Wildlife Conservation Strategy. TWRA, Nashville, Tennessee. 231 pp.

Wiggins, G. B. 1977. Larvae of the North American Caddisfly Genera (Trichoptera). University of Toronto Press, Buffalo, New York. 401 pp.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority change

Approve: _____ June 15, 2010
for Regional Director, Fish and Wildlife Service Date

Concur: _____ Date: October 22, 2010
ACTING
Director, Fish and Wildlife Service

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: March 2010

Conducted by: Cookeville, Tennessee Field Office